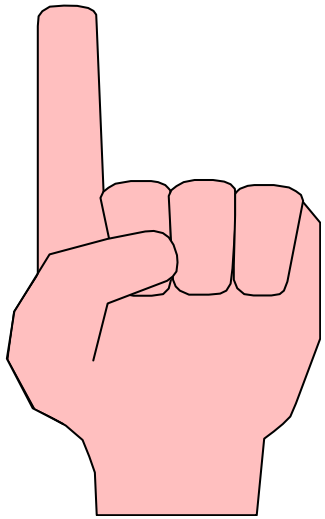
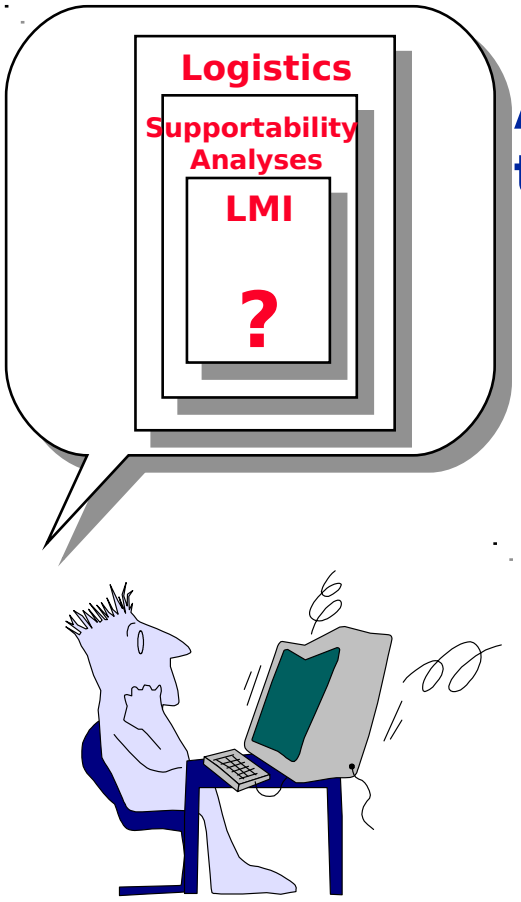
LM-715
Supportability Analyses



Given a scenario, choose the appropriate supportability analyses tools and techniques.

- Illustrate the need for supportability analyses and their role as integral part of the systems engineering process.
- Discuss supportability analyses methods throughout the system life cycle.
- Identify the applicable tools and techniques of supportability analyses in the systems engineering process.
- Relate the appropriate supportability analyses tools and techniques.

Supportability Analyses



Anything analytical that has something to do with support

- **SUPPORTABILITY ANALYSES:**

  Tailored application of engineering efforts during acquisition, to identify/solve logistics issues through an iterative SE process of definition, synthesis, tradeoff, T&E. (Mil Handbook 502)

- **LOGISTICS MANAGEMENT INFORMATION (LMI):**

  Documentation associated with supportability analyses.

  [See MIL-PRF-49506]

Policy

"Supportability factors are integral elements of program performance specification. However, support requirements are not to be stated as distinct logistic elements, but instead as performance requirements that relate to a system's operational effectiveness, operational suitability, and life-cycle cost reduction." *DoD 5000.2-R*

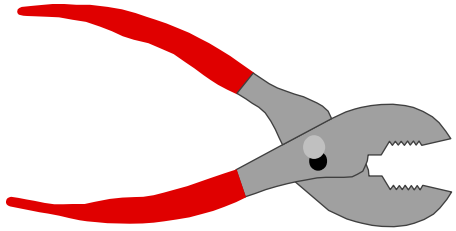
Policy

- Supportability analyses are integral parts of Systems Engineering.
- Supportability analyses form the basis for related design requirements in system specifications.
- .Supportability analyses form the basis for decisions: how to most cost-effectively support a system over its life cycle.
- Programs shall allow contractors maximum flexibility to propose most appropriate supportability analyses.

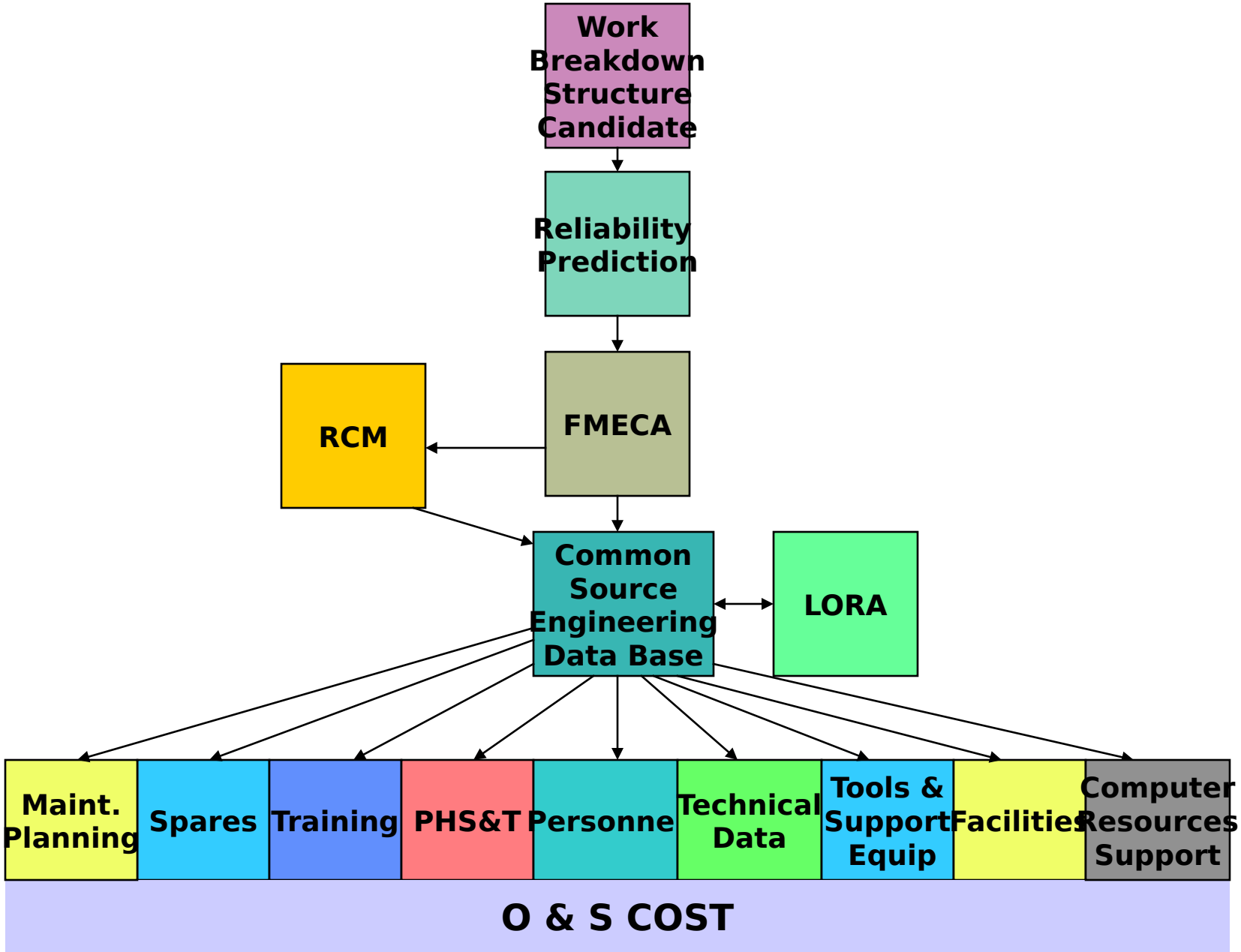
DoD 5000.2-R

Integrated Supportability Analyses Can Include:

- Maintenance Planning
- Manpower, Personnel and Training
- Facilities
- Failure Modes, Effects and Criticality Analysis (FMECA)
- PHS&T
- Supply Support
- Repair Level Analysis
- Life Cycle Cost (LCC) Analysis.
- Support & Test Equipment
- etc. ….



Supportability Analyses Process



BEST PRACTICE: Supportability Analyses

- ✓ Tailored !
- ✓ Part of iterative SE process
- ✓ Assists in:
  - ◆ Defining support
  - ◆ Influencing design
- ✓ Uses (not duplicates) other data & analyses
- ✓ Documented and communicated

Supportability Analyses in Practice

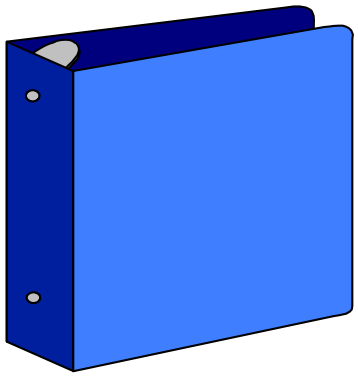
~~Maintenance Concept A~~

~~Maintenance Concept B~~

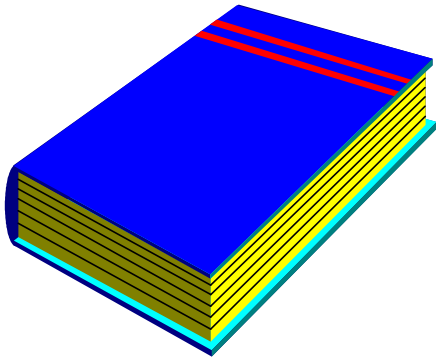
~~Maintenance Concept C~~

Logistics IPT

Supportability Analyses Results

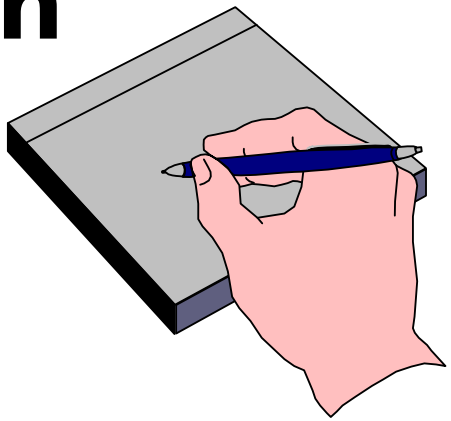


Support Plan



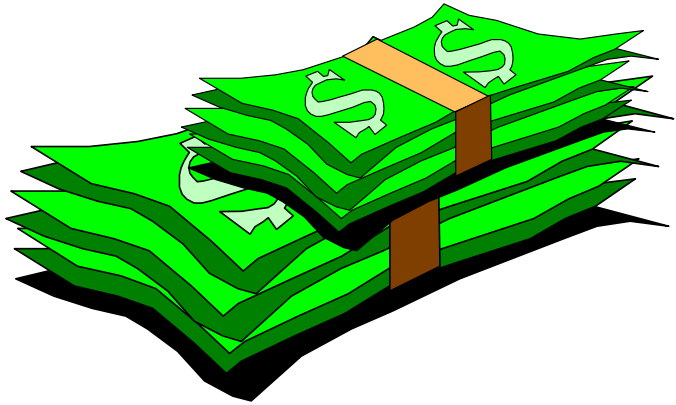
Specification

Supportability Is a Design Requirement - Not the Result of the Design



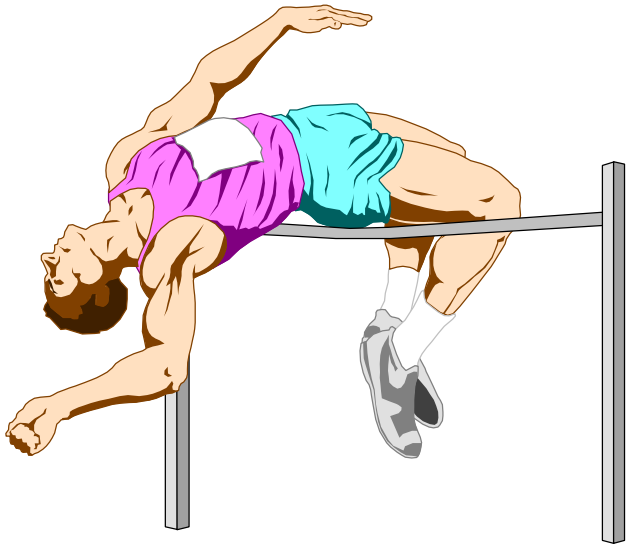
- Early focus results in:
  - support parameters stated in operational terms
    - readiness objectives
    - support costs

- Achieving & sustaining affordable system supportability [AKA - Affordable Readiness] is the result of sound systems engineering

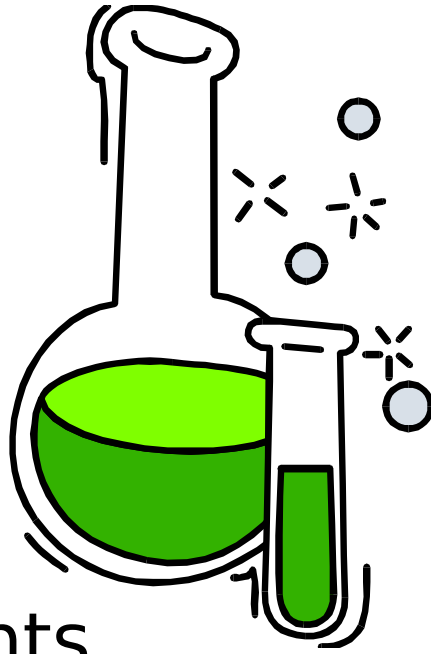


Supportability Analyses Provide Input to the Systems Engineering Strategy

- Strategy should address all supportability analyses needed to:
  - analyze, define and verify supportability threshold & objectives
- assess the risk in meeting the thresholds & objectives



Supportability Analysis Provides Input into the TEMP



- Methods & techniques encompass:
  - technical reviews
  - modeling & simulation
  - demonstration
  - testing
- All support performance requirements should be tested & verified.

Supportability Analyses for Commercial and NDI?

- **Questions:**
  - Commercial and NDI have sufficient data?
  - Commercial and NDI used in the same “operational” environment?
  - Commercial and NDI supportable with the same maintenance/logistic concept?
- **Results impact choice of supportability analyses**

Supportability Analyses Reports

Examples

Phases				
Preconcept	Concept Exploration	Program Def. and Risk Red.	Engineering & Manuf. Dev.	Prod., Fielding/ Deployment, Operational Spt.

- Maintenance Planning Summaries →
- Repair Analysis Summaries →
- Manpower, Personnel and Training Summaries
- Supply Support Summaries
- Support & Test Equipment Summaries
- Facilities Summaries
- PHS&T Summaries
- Post Production Support Summaries

These “and other*” reports to be tailored to Program needs.
*not all inclusive nor exclusive Source: Mil-Hdbk-502

HOW DO YOU DO SUPPORTABILITY ANALYSES?

Scientific Method Process

- Observation
- Problem Formulation
- State Research objectives
- Determine Casual Relationship
- Formulate Hypothesis
- State Research Methodology
- Test Hypothesis
- Formulate conclusions
- Communicate findings

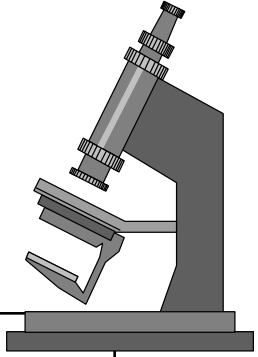
Nine Phase Decision Process

- Monitor Environment
- Define Problem
- Specify objective
- Diagnose the Problem
- Develop alternatives
- Establish Evaluation Criteria
- Appraise alternatives
- Choose Best Alternative[s]
- Implement Decision

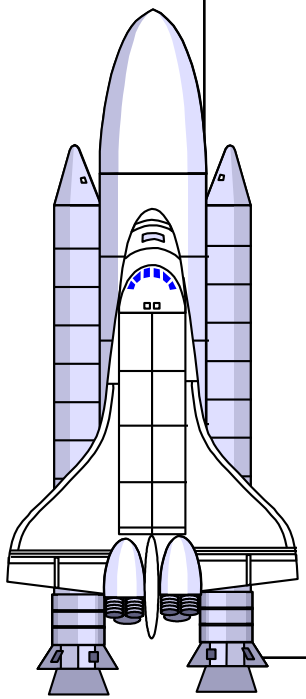
When all else fails, use your

Common Sense!

FAILURE MODES, EFFECTS AND CRITICALITY ANALYSIS (FMECA)



SYSTEM NAME	SUBSYSTEM NAME	COMPONENT NAME AND PART NO.	COMPONENT FUNCTION
SPACE SHUTTLE MP SRM 10-00	SRM CASE 10-06	CASE ASSEMBLY, FORWARD SEGMENT 10-05-01 1U50147-08	Example
AUTHOR AND COMPANY W. L. HANKINE THIOKOL CORPORATION	**DATE** JUNE 1983	**REVISION**	



MISSION PHASE	COMPONENT FAILURE MODE AFFECTED COMPONENT	FAILURE EFFECT ON A. SUBSYSTEM FUNCTION B. SYSTEM FUNCTION C. MISSION D. VEHICLE AND PERSONNEL	CRITICALITY CATEGORY	CONTROL METHODS TO INSURE A RELIABLE PRODUCT
	ASSEMBLY JOINTS LEAK.	A. HIGH TEMPERATURE GAS FLOW WILL CAUSE METAL EROSION AND PROBABLE BURNTHROUGH AND CASE BURST. B. CATASTROPHIC FAILURE OF SRM. C. MISSION LOSS. D. ***VEHICLE AND PERSONNEL LOSS.***	1	SEE CIL

PART NO.	PART NAME	QUANTITY PER COMPONENT
1U50131-09	CASE SEGMENT, CYLINDER	2
1U51473-01	CASE SEGMENT, FORWARD	1
1U50228-24	PACKING (O-RINGS)	2/JOINT
1U100269-01	TEST PLUG	1/JOINT
1U50228-15	PACKING (TEST PLUG)	1/PLUG

1.	TANG-A-DIAMETER EXCEEDS UPPER LIMIT OR SURFACE FINISH NONCONFORMING, OR IS GOUGEDRFACES.	(1)	1. TRAINED, QUALIFIED MACHINIST TO PERFORM MACHINING OPERATION. 2. SPECIAL PROFILE TEMPLATE TO CONTROL LATHE CUTTING HEAD.
2.	CLEVIS NONCONFORMING (DIAMETER, THICKNESS, FINISH).		
3.	CLEVIS O-RING GROOVES EXCEED WIDTH AND/OR DEPTH UPPER LIMITS OR CORRODED.	(1R)	3. 100% INSPECTION OF TANG-DIAMETER, CLEVIS, DIMEN - SIONS AND O-RING GROOVES
4.	0-RINGS NONCONFORMING OR DAMAGED DURING ASSEMBLY.	(1R)	USING PI TAPE AND STANDARD MEASURING INSTRUMENTS . SURFACE FINISH
5.	LEAK CHECK PLUG LOOSE OR WITHOUT O-RING, INNERMOST SEAL INEFFECTIVE PER 1 ABOVE OR THE CONDITIONS OF O-RING ARE PER 4 ABOVE.	(1R)	
6.	***FOREIGN MATERIAL IN O-RING GROOVES.***	(1)	SAMPLE INSPECTED BY SURF-INDICATOR.
7.	IGNITER FLANGE NONCONFORMING, FLATNESS FINISH.	(1R)	7. A. TRAINED, QUALIFIED MACHINIST TO PERFORM MACHINING OPERATION.
8.	CASE ASSEMBLY JOINT ROTATION CAUSES “LIFT-OFF” FROM SECONDARY O-RING (PRIMARY O-RING WILL REMAIN IN COMPRESSION).	(1R)	B. 100% INSPECTION OF IGNITER FLANGE FLATNESS BY TIR READOUT FINISH IS SAMPLE INSPECTED USING SURF-INDICATOR.
9.	EXPANSION OF CLEVIS GAP BECAUSE OF RESIDUAL STRAINS RESULTING FROM MANUFACTURING PROCESSES.	(1R)	